

SPECT Blood Pool Imaging On Bone Scintigraphy Improves Diagnostic Yield Compared To Planar Imaging: Initial Experience

S K Gupta, N Rutherford, L Allen

Citation

S K Gupta, N Rutherford, L Allen. *SPECT Blood Pool Imaging On Bone Scintigraphy Improves Diagnostic Yield Compared To Planar Imaging: Initial Experience*. The Internet Journal of Nuclear Medicine. 2013 Volume 6 Number 1.

Abstract

Blood pool (BP) phase is of high importance as it improves the specificity of the bone scintigraphy. Traditionally planar images are obtained, which are difficult to interpret primarily due to poor target to background ratio and lack of anatomical details. In a small retrospective study, we evaluated the value of BP SPECT over planar imaging (n=39). SPECT not only identified lesions in 12/26 (46%) of the negative planar studies but also improved visualization (n=9), localization (n=9) and showed additional lesions (n=5) in the remainder. In this pilot study, SPECT improved the value of BP phase, potentially impacting the management.

INTRODUCTION

Blood pool (BP) images are acquired within 10 minutes of tracer injection and reflect the alterations in the bone extracellular fluid from changes in capillary permeability and indicates an inflammatory component to the lesion (1). It helps differentiating various causes of uptake (2), improves the specificity of bone scan (3) (4) (5) and may identify soft tissue pathologies (6). However, traditional blood pool planar (BPP) images are difficult to interpret due to lower target to background ratio; overlying organ activity also precludes the satisfactory interpretation (5). Furthermore, relative lack of anatomical detail may lead to false positives reporting (7).

METHODS

SPECT is known to improve sensitivity, specificity and diagnostic accuracy of delayed phase of bone scintigraphy (8). In our institution, blood pool SPECT (BPS) is performed on a case to case basis at the physician's discretion. 800-1100 MBq of Tc-99m MDP is injected and BPP (two minutes/frame) and BPS (5 minutes acquisition) are obtained. If CT has been obtained in the delayed images, this may be fused with the BPS using semiautomated software registration algorithm on Xeleris-3 (GE healthcare) workstation.

RESULTS

In this small study, assessing the value of BPS, 39

consecutive bone scans (abdomen/pelvis, n=18; head and neck, n=11; and chest, n=10) were independently reviewed by two experienced nuclear medicine physicians (and 3rd physician in the event of discrepancy). All patients were non-oncological and had localized symptoms. BPP were negative in 26 but BPS identified lesions in 12 of these. Of the positive BPP studies, BPS improved visualization and localization in 9 each as well as showed additional lesions in 5 studies. Physicians felt BPS had potential impact in the management in 11 of all 39 studies.

FIGURE 1

A 91-year-old male underwent bone scintigraphy for evaluation of skull base osteomyelitis. The BPP images (A) are difficult to characterize. BPS (B), however, clearly shows hyperaemia in the soft tissue rather than associated with bone. This case illustrates potential value of BPS in identifying the soft tissue pathologies and its localization value when co-registered with CT.

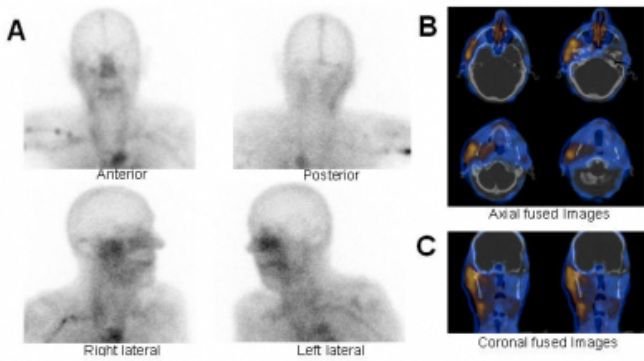


FIGURE 2

A 50-years-old male with back pain following fall two weeks ago. BPS (B, C) clearly show T6 vertebral hyperaemia, which is difficult to appreciate on BPP (A) probably due to superimposed cardiac and mediastinal blood pool activities (Note the blood pool cardiac activity in the same horizontal plane). This is associated with avid delayed tracer uptake (D), consistent with recent fracture. This case illustrates improved sensitivity with BPS in identifying the hyperaemic lesions.

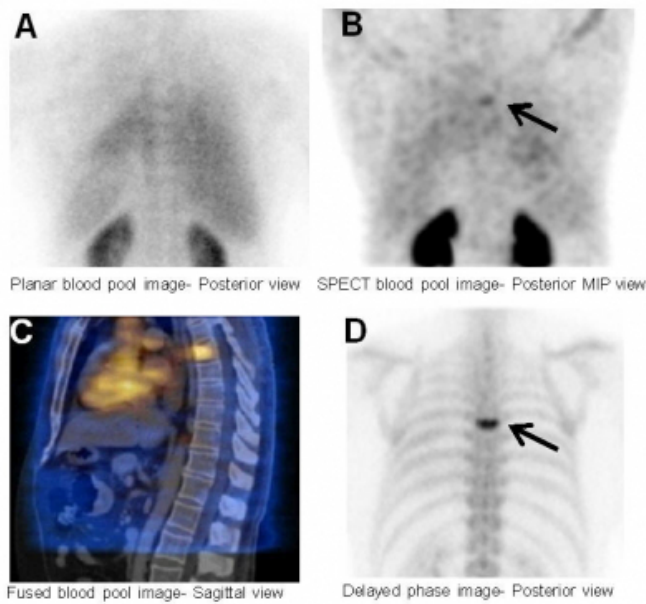


FIGURE 3

A 77-years-old female with neck pain was referred for bone scintigraphy. BPP images are normal (A) but BPS (B, C) shows focal mild hyperaemia at left C2/3 facet joint. The BPP was unable to identify the hyperaemic lesion due to neck vascular activities. There is avid delayed tracer uptake at this site (D) consistent with facet joint arthritis. This case illustrates potential value of BPS in areas of difficult anatomy.

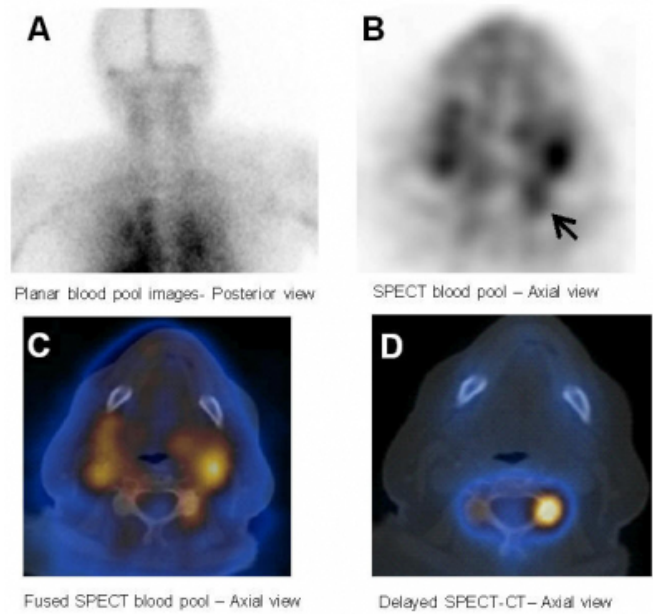
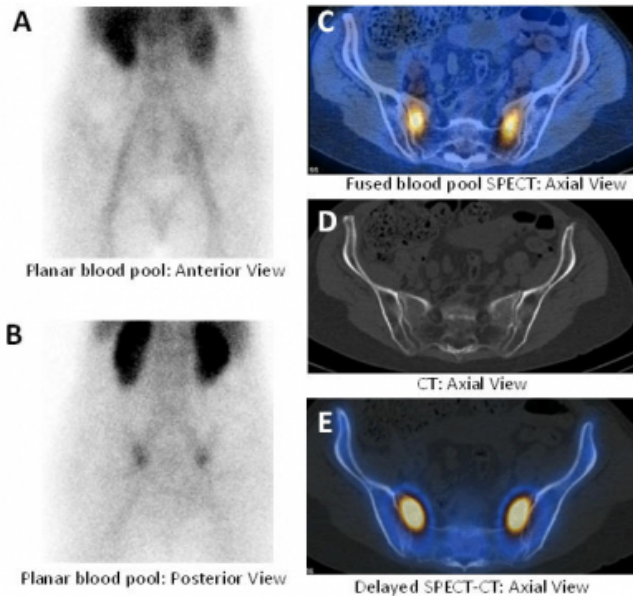


FIGURE 4

A 68-years-old female with recent onset sacral region pains. (Not a current study patient) BPP shows symmetrical hyperaemia in the SI joints bilaterally (A,B). BPS confirmed hyperaemia, in fact, to be localized to the sacral ala bilaterally with sparing of SI joints. (C) Delayed images (D, E) and MRI (Images not shown) confirmed presence of insufficiency fracture rather than sacroiliitis. This case illustrates the excellent localization value of BPS when co-registered with CT.



DISCUSSION AND CONCLUSION

Although this is a smaller study, BPS does appear to

improve the value of the early phase of bone scintigraphy. Future studies, however, will be needed to further elaborate the impact on the management.

References

1. McCullough RW, Gandsman EJ. Pathophysiologic interpretation of time activity curves in dynamic bone imaging. *Clin Nucl Med.* Jul 1988;13(7):517-524.
2. Mohan HK, Clarke SE, Centenara M, Lucarelli A, Baron D, Fogelman I. Value of lateral blood pool imaging in patients with suspected stress fractures of the tibia. *Clin Nucl Med.* Mar 2011;36(3):173-177.
3. Abdel-Dayem HM. The role of nuclear medicine in primary bone and soft tissue tumors. *Semin Nucl Med.* Oct 1997;27(4):355-363.
4. Delbeke D, Habibian MR. Noninflammatory entities and the differential diagnosis of positive three phase bone imaging. *Clin Nucl Med.* Nov 1988;13(11):844-851.
5. Gandsman EJ, McCullough RW. Dynamic bone imaging in the differential diagnosis of skeletal lesions. *Int J Rad Appl Instrum B.* 1990;17(6):533-541.
6. Drinkwine BJ, Turton DB. Unilateral pulmonary oligemia detected on blood pool images from a Tc-99m MDP bone scan. *Clin Nucl Med.* Dec 2009;34(12):941-942.
7. Veluvolu P, Collier BD, Isitman AT, Schwab JP, Hellman RS, Peck D. False-positive planar bone image due to horse shoe kidney. Evaluation with blood pool image and SPECT. *Clin Nucl Med.* Apr 1985;10(4):292-293.
8. Savelli G, Maffioli L, Maccauro M, De Deckere E, Bombardieri E. Bone scintigraphy and the added value of SPECT (single photon emission tomography) in detecting skeletal lesions. *Q J Nucl Med.* Mar 2001;45(1):27-37.

Author Information

Sandeep K Gupta, FRACP, Staff specialist

Department of Nuclear Medicine & PET John Hunter and Calvary Mater Hospitals

Newcastle NSW, AUSTRALIA

Sandeep.Gupta@hnehealth.nsw.gov.au

Natalie Rutherford, FRACP, Staff specialist

Department of Nuclear Medicine & PET John Hunter and Calvary Mater Hospitals

Newcastle NSW, AUSTRALIA

Len Allen, FRACP, Staff specialist

Department of Nuclear Medicine & PET John Hunter and Calvary Mater Hospitals

Newcastle NSW, AUSTRALIA